Changing organizational structures of jihadist networks in the Netherlands

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ABSTRACT

This paper uses Social Network Analysis to study and compare the organizational structures and division of roles of three jihadist networks in the Netherlands. It uses unique longitudinal Dutch police data covering the 2000–2013 period. This study demonstrates how the organizational structures transform from a hierarchical cell-structure with a clear division of labor to horizontal and dense networks with less clear orientation on tasks. The core member types in the jihadist movement transform from international jihad veterans with clear leadership skills to homegrown radicals with less status and often a lack of expertise.

1. Introduction

This paper focuses on the jihadist movement in the Netherlands and analyzes unique longitudinal Dutch police data. We use Social Network Analysis (SNA) to capture changes in the organizational features of Dutch jihadist networks and their members' roles during the 2000–2013 period. SNA is ideally suited to uncover the structure, social dynamics, and members' position in a group, including illicit networks.[1] Over the last decade studies have used SNA to illuminate the organizational structures of terrorist groups.[2] SNA has been used to visually map structures,[3] identify key players,[4] and uncover organizational developments over time.[5] These studies have deepened our understanding of terrorist groups, particularly jihadist networks. The current study extends prior research by combining their objectives and discussing several concepts and approaches.

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[1] Steve Ressler, "Social network analysis as an approach to combat terrorism: past, present, and future research," Homeland Security Affairs 2, no. 2 (2006), pp. 1–10.
[2] See e.g. Kathleen M. Carley,, Ju-Sung Lee, and David Krackhardt, "Destabilizing networks," Connections 24, no. 3 (2002), pp. 79–92, Renée C. Van der Hulst, "Terroristische netwerken en intelligence: een sociale netwerkanalyse van de Hofstadgroep," Tijdschrift voor Veiligheid 8, no. 2 (2009), pp 8–27, Eric Stollenwerk, Thomas Dörfler, and Julian Schibberges, "Taking a New Perspective: Mapping the Al Qaeda Network Through the Eyes of the UN Security Council,"Terrorism and Political Violence ahead-of-print (2015), pp. 1–21.

[3] Stuart Koschade, "A social network analysis of Jemaah Islamiyah: The applications to counterterrorism and intelligence," Studies in Conflict & Terrorism 29, no.6 (2006), pp. 559–575, Shandon Harris-Hogan, "Australian Neo-Jihadist Terrorism: Mapping the Network and Cell Analysis Using Wiretap Evidence," Studies in Conflict & Terrorism 35, no.4 (2012), pp. 298–314.
[4] Ami Pedahzur and Arie Perliger, "The changing nature of suicide attacks: a social network perspective," Social forces 84, no.4 (2006), pp. 1987–2008, Van der Hulst, "Terroristische netwerken en intelligence," Edith Wu, Rebecca Carleton, and Garth Davies, "Discovering bin-Laden's Replacement in al-Qaeda, using Social Network Analysis: A Methodological Investigation," Perspectives on Terrorism 8, no.1 (2014), Roberta Belli, Joshua D. Freilich, Steven M. Chermak, and Katharine A. Boyd, "Exploring the crime-terror nexus in the United States: a social network analysis of a Hezbollah network involved in trade diversion," Dynamics of Asymmetric Conflict 8, no.3 (2015), pp. 263–281.
[5] Sudhir Saxena, K. Santhanam, and Aparna Basu, "Application of social network analysis (SNA) to terrorist networks in Jammu & Kashmir," Strategic Analysis 28, no.1 (2004), pp. 84–101, José A. Rodríguez, "The March 11 th terrorist network: In its weakness lies its strength," Unpublished manuscript (2005), Justin Magouirk, Scott Atran, and Marc Sageman, "Connecting terrorist networks," Studies in Conflict & Terrorism 31, no.1 (2008), pp. 1–16, Javier Jordan, "The Evolution of the Structure of Jihadist Terrorism in Western Europe: The Case of Spain," Studies in Conflict & Terrorism 37, no.8 (2014), pp. 654–673. Several of the mentioned studies have combined more than one purpose.

Academics and policy analysts have both highlighted the need to pay attention to criminal and terrorist networks' features. The organizational structures of illicit networks are highly affected by the outcome of an *efficiency-security trade-off*. Efficiency refers to the shortest possible way of communication, which is necessary to effectively execute tasks. *Dense* and decentralized networks have the most suitable structure to achieve efficiency because they contain many direct communication lines among their members. Conversely, secrecy refers to minimal communication between members to avoid exposing the network. A suitable network structure would therefore be centralized and less dense with mainly strong ties, minimizing the level of direct information transfers and maximizing trust between and among members.[6] In essence, the trade-off means that illicit networks need to balance the need to act collectively and the need to maintain trust and secrecy within collaborative settings to effectively withstand law enforcement interventions.[7] Allegedly, most terrorist networks choose security over efficiency because they often aim for a one-time, significant action. These networks prefer not to rush their plans and to maximize the likelihood of their one time attack by avoiding frequent communication and maintaining a low profile.[8] Yet, to achieve their desired aim, they cannot completely dismiss efficiency.

Many therefore conclude that the necessary balance between efficiency and security is the *compartmentalization* of networks, which is based on Granovetter's *weak-and-strong-ties* concept.[9] Compartmentalizing the network into cohesive sub-cells with strong redundant social ties, that only have weak non-redundant social ties with other sub-cells and/or a network's core, ensures that the entire network will not be exposed if a member or sub-cell is removed by law enforcement interventions. This increases efficiency within the sub-cells, but maintains the security of the network as a whole.[10] Helfstein & Wright, however, argue that this network type may not in fact be used by all terrorist networks.[11] This warning against hasty assumptions can be endorsed via the notion that SNA is relatively difficult to apply on illicit networks due to their covertness and fuzzy boundaries.[12] Covertness makes it difficult to determine who belongs to a network. These difficulties highlight the possibility of missing data and incorrect relations,

which can affect the quantitative SNA measures that are highly sensitive for minor adjustments.

Another important point concerns the role and position of a network's key player. It is often claimed that high actor level centrality scores classify individuals' roles. For instance, a subject is considered a *leader* when she/he has many direct contacts (high *degree centrality*), due to their centralized position.[13] Also, a subject is considered a *broker* when she/he is on the geodesic path (shortest route) between two unrelated subjects (high *betweenness centrality*). In other words, when she connects isolated or distanced compartments within the network.[14] It is often assumed that identifying these key players will result in effective strategies to disrupt the network,[15] although this is disputed. Some claim that the removal of centralized actors only has a temporary effect, often caused by the network's resilience and ability to find an immediate replacement.[16] In addition, the most centralized actors are not always the most important actors,[17] but rather the most visible ones.[18] This could be due to the distinction between social and human capital. Whereas the former reflects the amount of a person's connections, the latter displays personal qualities, such as skills and expertise.[19] These qualities are difficult to capture with centrality metrics. Targeting and removing central actors may not be the silver bullet to counter-terrorism strategies.[20] Rather it may be necessary to assess both the actor's social and human capital by relying on centrality metrics and a qualitative analysis, to determine the actor's centralized position and his or her qualities and assets.[21]

Finally, most SNA studies only portray a static picture of clandestine networks.[22] These SNA studies highlight how a particular network operates at one specific moment in time, without comparing them to networks from different periods. While focusing on a single time period is useful, it overlooks organizational differences or the transformation of group members' roles, positions, and activities.[23] Moreover, there is only limited attention paid to whether changing organizational features and roles affect each other over time. Identifying dynamic changes could aid policy makers in devising more effective counter terrorism measures.

The discussion thus far demonstrates that findings about illicit network structures and roles are interesting but should be interpreted with caution. This study therefore uses SNA to examine to what extent particular network features and assumptions apply to

[6] Valdis E. Krebs, "Mapping networks of terrorist cells," Connections 24, no.3 (2002), pp. 43–52, Rodriguez, "The March 11th terrorist network," Koschade, "A social network analysis," Aili E. Malm, J. Bryan Kinney, and Nahanni R. Pollard, "Social network and distance correlates of criminal associates involved in illicit drug production," Security Journal 21, no.1 (2008), pp. 77–94.

[7] Carlo Morselli, Cynthia Giguère, and Katia Petit, "The efficiency/security trade-off in criminal networks," Social Networks 29, no.1 (2007), p.144.

[8] Krebs, "Mapping networks," Morselli e.a., "The efficiency/security trade-off." See also Efstathios D. Mainas, "The analysis of criminal terrorist organizations as social network structures: a quasi-experimental study," International Journal of Police Science & Management 14, no. 3 (2012), pp 264–282 for an empirical analysis based on police information.

[9] Mark S. Granovetter, "The strength of weak ties," American journal of sociology (1973), pp. 1360–1380.

[10] Wayne E., Baker and Robert R. Faulkner, "The social organization of conspiracy: Illegal networks in the heavy electrical equipment industry," American sociological review (1993), pp. 837–860, Julie Ayling, "Criminal organizations and resilience," International Journal of Law, Crime and Justice 37, no.4 (2009), pp. 182–196, Pedahzur and Perliger, "The changing nature of suicide attacks," Jean Marie McGloin, "Policy and intervention considerations of a network analysis of street gangs," Criminology & Public Policy 4 (2005), pp 607–636, Xu & Chen, "The topology of dark networks," Communication of the ACM 51 (2008), pp 58–65.

[11] Scott Helfstein and Dominick Wright, "Covert or convenient? Evolution of terror attack networks," Journal of Conflict Resolution (2011), pp 1–29.

[12] Malcolm K. Sparrow, "The application of network analysis to criminal intelligence: An assessment of the prospects," Social networks 13, no.3 (1991), pp. 251–274, Morgan Burcher and Chad Whelan, "Social network analysis and small group 'dark'networks: an analysis of the London bombers and the problem of 'fuzzy'boundaries," Global Crime 16, no.2 (2015), pp. 104–122.

[13] Jialun Qin, J.J. Xu, D. Hu, Marc Sageman and H. Chen, "Analyzing terrorist networks: A case study of the global salafi jihad network," Intelligence and security informatics (Berlin/Heidelberg: Springer, 2005), pp. 287–304, Edith Wu, Rebecca Carleton, and Garth Davies, "Discovering bin-Laden's Replacement in al-Qaeda, using Social Network Analysis: A Methodological Investigation,"Perspectives on Terrorism 8, no.1 (2014), Stollenwerk e.a., "Taking a New Perspective".

[14] E.g. Saxena e.a., "Application of social network analysis," Van der Hulst, "Terroristische netwerken en intelligence," Carlo Morselli, and Julie Roy, "Brokerage qualifications in ringing operations,"Criminology 46, no.1 (2008), pp. 71–98.

[15] McGloin, "Policy and intervention considerations," Koschade, "A social network analysis," Morselli and Roy, "Brokerage qualifications".

[16] Sam Mullins, "Social network analysis and counter-terrorism: measures of centrality as an investigative tool," Behavioral Sciences of Terrorism and Political Aggression 5, no.2 (2013), pp. 115–136, Paul AC Duijn, Victor Kashirin, and Peter MA Sloot, "The relative ineffectiveness of criminal network disruption," Scientific reports 4 (2014).

[17] Carley e.a., "Destabilizing networks," Mullins, "Social network analysis".

[18] Marilyn B. Peterson, Applications in criminal analysis: A sourcebook (Westport, CT: Greenwood Press, 1994).

[19] Duijn, e.a., "The relative ineffectiveness".

[20] Helfstein & Wright, "Covert or convenient?".

[21] Van der Hulst, "Terroristische netwerken en intelligence," p.24, Duijn, e.a., "The relative ineffectiveness".

[22] Sam Mullins and Adam Dolnik, "Terrorist Networks and Small Group Psychology," The Faces of Terrorism–Multidisciplinary Perspectives (West Sussex: John Wiley & Sons Ltd, 2009), pp. 137–150.

[23] Mullins, "Social network analysis," Xu & Chen, "The topology of dark networks".

jihadist networks in the Netherlands. Although several studies have already applied SNA to Dutch case studies,[24] they did not investigate possible changes of network features over time. To verify the network features and assumptions, we therefore analyzed the temporal development of the jihadist movement of the Netherlands between 2000 and 2013, by comparing different jihadist networks from different points in time. Our goal is to identify differences and similarities in these networks' *organizational structures* and *subjects' roles*. Through mapping and visualizing the networks via SNA, a mental picture of complex linkages is provided[25] that enabled us to discover patterns of behavior. We used a mixed-method of qualitative and quantitative analysis, which adds a layer of precision to the connection of social ties and its influence on behavior.[26] Instead of focusing on global jihadist movements or international terrorist organizations, our focus is on local jihadist networks in a western European country. This may aid policymakers in their attempt to counter terrorism, as many countries have struggled with implementing strategies to respond to the concern of western European Muslims travelling to ISIS controlled territories to participate in the Jihad.[27] It is important to empirically uncover the local networks behind foreign fighters and see how these networks differed over the years.

The following section describes our data and methods. Next, we outline our quantitative results followed by a combination of our quantitative and qualitative findings. Finally, we explain the differences between networks and discuss our research's policy implications.

2. Data and methods

2.1. Data

We used unique official Dutch data from police investigations that focused on terrorist activities. We analyzed the police files both quantitatively and qualitatively. We employed mixed methods to deepen our understanding of the phenomenon and reduce the aforementioned risk of misinterpretation.[28] We were granted access to 28 voluminous confidential police investigations into jihadist terrorism between 2000 and 2013 that involved hundreds of individuals who belonged to different jihadist networks. Based on these police files, this study sampled 209 unique persons for further analysis. These 209 individuals were not all terrorists or violent extremists and not all of them were convicted or indicted with criminal charges. Our inclusion criteria for the 209 subjects were that: (1) a subject expressed extremist jihadist[29] sympathies or that he/she explicitly facilitated such a sympathizer; (2) we were able to gather information on the subject beyond his/her personal details; and (3) the subject lived or regularly resided in the Netherlands. If the subject did not live in the Netherlands, but played an indispensable role in the network nonetheless, he or she was also included.

The police investigations yielded rich data based on various sources such as (i) original wire taps of telephone and internet communication, (ii) recordings of in-house communication,

(iii) transcripts of suspect interrogations, and witness statements, (iv) observation reports, (v) forensic reports, house searches, and expert-witness reports, and importantly, (vi) complete and verbatim court transcripts and lawyers' statements. Court data are considered the most reliable of data sources in terrorism research.[30] We used a data collection sheet to systematically gather information from the police files, which contained several items concerning group structure, individual biographies, activities, ideology, and the recruitment process. We also conducted 28 semi-structured interviews with leading police investigators, public prosecutors and criminal defense lawyers who were involved in the police investigations. The interviews were recorded and transcribed and thus allowed us to contextualize our archival information. Finally, we attended over 10 court sessions of the criminal cases that were still under judicial review, which resulted in a large volume of valuable field notes.

For the purposes of the current paper, the information from the police files, interviews, and field notes was transformed into a data set suitable for quantitative SNA, which will be discussed below. The use of police files, or at least archival data and court documents, is often praised by scholars[31] when applying SNA to clandestine networks, and again it has been labelled by some as the 'gold standard'.[32] The reason for this is that this source contains a large amount of relational data, documented over an extended period of time, which makes it highly suitable to uncover social interaction and has allowed us to accomplish our research goals.[33]

2.2. Network conceptualization

In the remainder of this paper we use the term *(jihadist) network* as our unit of analysis. The studied networks are a selection of individuals from the aforementioned 209 subjects. We categorized individuals as belonging to one *jihadist network* when these subjects interacted with each other during a particular episode, while conducting activities together that were aimed at particular objectives, in which the Jihadi-Salafist ideology played a central role. Hence, the network boundaries are foremost formed by the subjects' interactions, activities, and shared violent jihadist ideology, rather than actual terrorist or violent acts.

To illuminate jihadist network structures in different time periods in the Netherlands, we selected three networks that were similar in core activities, but differed in when they operated. On the one hand, all three networks primarily aimed at *facilitating foreign fighting journeys* to conflict areas, *disseminating* and *consolidating the Jihadi-Salafi doctrine*, and *conducting criminal activities*. On the other hand, each network represented a particular episode that together covered the larger time-frame 2000–2013. Network 1 operated between 2001 and 2002 and contained 34 individuals. The average age is 28.7 years and most members were born outside the Netherlands. It operated during a time when jihadist networks did not receive significant attention from the police, the media, or the public. During this period the jihadist movement started to emerge in the Netherlands, network 1 can be considered one of the pioneering networks. We identified this network by merging three criminal cases, containing four police investigations.

Network 2 operated between 2005 and 2006 and contained 25 individuals. The average age is 22.2 years and many subjects are

[24] Van der Hulst, "Terroristische netwerken en intelligence," Duijn, e.a., "The relative ineffectiveness".

[25] Saxena e.a., "Application of social network analysis".

[26] Aili Malm, Rebecca Nash, and Ramin Moghaddam, Social Network Analysis and Terrorism, forthcoming.

[27] See also Jasper L. de Bie, Christianne J. de Poot, and Joanne P. van der Leun, Shifting modus operandi of jihadist foreign fighters from the Netherlands between 2000 and 2013: a crime script analysis,Terrorism and Political Violence 27, no.3 (2015), pp. 416–440.

[28] Van der Hulst, "Terroristische netwerken en intelligence".

[29] Willingness to use or accept violence in order to return to a pure interpretation of the Islam as it was supposedly lived in the original Muslim community (Umma) in the time of the prophet Muhammed and the following three caliphates.

[30] Joshua D. Freilich, Steven M. Chermak, Roberta Belli, J. Gruenewald, and William S. Parkin, "Introducing the United States extremis crime database (ECDB)," Terrorism and Political Violence 26, no.2 (2014), pp. 372–384, Marc Sageman, Understanding terror networks (University of Pennsylvania Press, 2004).

[31] Baker and Faulkern, "The social organization of conspiracy," Krebs, "Mapping networks".

[32] Belli e.a., "Exploring the Crime-Terror Nexus."

[33] Koschade, "A social network analysis," p.562.

second generation migrants born in the Netherlands. Network 2 operated immediately after the first spike of societal attention for jihadism. Whereas these subjects had specific predecessors they could use as an example, the police were also more aware of their existence. We identified network 2 by using a single criminal case, containing two police investigations.

Finally, network 3 operated between 2008 and 2013. The average age is 23.7 years and most subjects are second generation migrants born in the Netherlands. The third network had a much longer life span than the other two networks. The third network is based on a variety of police evidence, from four different police investigations, that did not lead to one coherent criminal case. As a result, none of these investigations led to the collapse of the network, as was the case with the first two networks, and the network continued to exist. Moreover, the network continued to exist and was still active when the police information was analyzed for this research. A complete and conclusive picture of network 3 can therefore not be guaranteed. Nonetheless, these independent investigations provided valuable information to conduct SNA.

2.3. Quantitative analysis

Interactions between subjects were quantified to conduct SNA. An observed interaction between two subjects was labelled an undirected tie. Such interactions include face to face meetings, or internet and telephone communication. Hence, unlike some other studies, the dyads in our study mean that the nodes actually know each other. We also measured the frequency or intensity of the interaction; in other words, the strength of the relation. We registered all observed ties in a value matrix, in which the rows and columns are defined by the subjects (i.e. nodes) and the cell values indicate the strength of the relationship between two nodes. The strength of the relationship measured as one of three values: a "1" indicating a "weak" relationship (i.e., at least one interaction between two subjects, although more interactions are likely). "3" indicating a "moderate" relationship (i.e. multiple interactions between two subjects), or "5" indicating a "strong" relationship (i.e., frequent interactions between subjects).

We next processed the valued matrices in SNA software packages "Pajek" and "Gephi", which enabled us to apply the previously mentioned network metrics *density, degree, betweenness* and *closeness* centrality. *Density* refers to the proportion between the number of observed ties and the maximum number of all possible ties in a network.[34] A density score ranges from 0 (no ties) to 1 (everyone is connected to each other). *Degree centrality* refers to the number of direct contacts a node has, which according to the literature implies a subject with power or leadership. Standardized scores range from 0 to 1; a high score indicates that a subject is directly connected to many others in the network, whereas a low score indicates direct connections to only a few subjects. *Weighted degree centrality* also incorporates the strength of a relationship. A high score indicates that a subject has a strong relationship with many others in the network, whereas a low score indicates weak connections to only a few subjects. *Betweenness centrality* refers to the extent a particular node is the shortest path between pairs of nodes in the network and therefore has a potential for control of communication,[35] which implies the subject had a broker position. Standardized scores range from 0 to 1; a high score means that many short paths go through this node, whereas a low score indicates that none or a few short paths go through this node. *Closeness centrality* refers to the ability of subjects to access other

subjects and measures the number of steps it takes for a subject to reach another subject. Unlike degree centrality, closeness centrality scores reflect the indirect contacts of a subject. A high score means that a subject has relatively short paths to other subjects in the network and is thus able to access others easily, whereas a low score means his paths are relatively long, which makes other nodes less accessible.[36] Together, these metrics indicate a subject's centrality and power in the network.

We also examine to what extent the networks balance efficiency and security. The literature argues that a compartmentalized network, containing dense clusters that are weakly connected to other clusters, is the most ideal network structure to ensure a balance between efficiency and security. To measure the extent of such compartmentalization, we used the *modularity* measure, which identifies meaningful communities and incorporates the weight or strength of the relations. Modularity looks for communities of nodes that are more densely and strongly connected to each other than would be expected if they were connected by chance. It is a measure that is used to look for how "good" a clustering actually is.[37] Networks with a high modularity score have a strong community structure. The nodes within the communities have dense and strong connections, but sparse or weak connections with nodes from other communities.[38] A modularity score of 0 means that the measured communities are purely random, whereas values above 0.3 are considered good and meaningful divisions.[39] Because these meaningful communities, unlike some other embedding measures, have little overlap and are based on tie strength, the compartmentalization of the network can be visualized in a sociogram in a more unobstructed and therefore eloquent way. This enables us to see whether a network has strong, relatively autonomous, communities that are sparsely connected, thus balancing between efficiency and security.

Finally, because we first want to understand to what extent particular SNA assumptions are applicable to Dutch networks, we think centrality metrics and modularity are suitable measures to achieve this goal in combination with the qualitative assessment of the networks and roles.

2.4. Qualitative analysis

The information from the police files, interviews, and field notes was also coded to conduct a qualitative analysis. The coding process was inspired by grounded theory principles[40] and managed with the help of software program MAXQDA. It started with an open or initial coding procedure, which in this study was the 'incident-by-incident' coding.[41] While comparing different incidents (segments of texts), particular relevant codes regarding the subjects' social relationships and roles emerged. Subsequently, 'focused coding' was applied to assess the initial codes' adequacy and depth. Through this procedure, the codes developed into useful concepts about the activities, network structures, and division of roles. By constantly comparing data with data, data with codes

[34] Belli e.a., "Exploring the Crime-Terror Nexus".

[35] Linton C. Freeman, "Centrality in social networks conceptual clarification," Social networks 1, no.3 (1979), pp. 215–239.

[36] Ibid.

[37] Benjamin H. Good, Yves-Alexandre de Montjoye, and Aaron Clauset, "Performance of modularity maximization in practical contexts," Physical Review E 81, no.4 (2010), pp. 1–20.

[38] Mark E.J. Newman, "Modularity and community structure in networks," Proceedings of the National Academy of Sciences 103, no.23 (2006), pp. 8577–8582.

[39] Mark E.J Newman and Michelle Girvan, "Finding and evaluating community structure in networks." Physical review E 69.2 (2004), pp 1–20.

[40] See also Jasper L. de Bie and Christianne P. de Poot, "Studying police files with grounded theory methods to understand jihadist networks," Studies in Conflict & Terrorism 39, no.7–8 (2016), pp. 580–601.

[41] Kathy Charmaz, Constructing Grounded Theory (London: Sage, 2006), p.57.

Table 1
network level descriptives and metrics.

	Network 1	Network 2	Network 3
Years of operation	2001–2002	2005–2006	2008–2013
Size	34 subjects	25 subjects	25 subjects
Density	0.210	0.380	0.393
Average node	6.94	9.12	9.44
Average path length	2.266	1.687	1.637
Modularity	0.471 (4 communities)	0.305 (3 communities)	0.232
Degree CD(ni)	0.388	0.466	0.435
Betweenness CB(ni)	0.464	0.185	0.158
Closeness CC(ni)	0.524	0.466	0.435

and qualitative concepts, the qualitative findings were specified and elaborated.[42]

2.5. Limitations

The use of police files as primary data source for grounded theory methods and SNA has a few limitations. First, we may be analyzing an incomplete network because the police may not monitor all potential jihadist sympathizers, or measure all interactions between them. These missing individuals may lead to validity and reliability issues, especially with regard to the centrality metrics.[43] Relatedly, because the subjects do not seem to have an explicit policy about who to include in their network, and they probably do not have a solid idea themselves about what constitutes their network, the boundaries of a network should be considered unclear or fuzzy.[44]

Also, our findings may be influenced by a selection bias. The observed network structures may be the outcome of a particular police investigation strategy, and the differences between networks over time may have been caused by adjustments in police investigation strategies. In other words, the police may have identified particular network structures in the past, but prioritized one over the other at different stages. On the other hand, we merged particular police investigations to identify our own types. This is a great advantage of the current study, because it enabled us to look beyond predetermined organizational structures.

3. Quantitative results

We conducted basic quantitative analysis to compare the three networks. These results are captured in Table 1.

Several metrics in Table 1 show how well the nodes or subjects are connected. Network 1 has a notably lower *density* of 0.210, meaning that only 21% of all possible connections exist, whereas the other networks have a considerably higher density of respectively 38% and 39.2%. Over time, the studied Dutch jihadist networks have become denser and the subjects have become more connected to other jihadists. Although all density scores seem low at first sight, they are actually relatively high compared to other terrorist[45] and organized crime networks[46] that often portray density scores between 10 and 20% or lower. The fact that network 1 is less dense also means that although it is a considerably larger network, it's subjects have on average less connections and need a longer route to get to other nodes than the subjects in other networks. We thus conclude that over the years, finding access to others became easier for the subjects in the studied networks. This is further accentuated by the modularity scores, which indicate how well subjects cluster in larger communities. Networks 1 and 2 have stronger community structures than network 3 and the modularity score of network 3 is slightly under the threshold of 0.3. This means the clustering structure of network 3 is less meaningful, which could be the effect of a dense network.

In addition, the network level centrality scores (degree, betweenness, and closeness) show the extent of variety in actor level scores. All three networks indicate a moderate centralized structure due to their similar *degree* scores of around 0.4. However, network 2 and 3 score higher, implying that these networks are somewhat more centralized around a few prominent people. It must be stressed that the centrality score of network 1 is heavily affected by the network size, which is larger than the other networks. This may affect its degree centralization. With regards to betweenness, network 1 scores considerably higher than the other networks, implying that there are a few prominent subjects in network 1 who connect isolated parts of the network. This is less so in the other networks which were active in later stages of the studied time-frame. The higher closeness score of network 1 indicates more variety among the subjects in the degree to which they have access to indirect contacts in this network.

To determine whether the three centrality measures are significantly different between the three studied networks, we measured the actor level degree, betweenness, and closeness scores (see Tables 3–5 for the actor level scores within each separate network) and then compared the network means by conducting a Kruskall-Wallis test (a Levene test showed unequal variances between networks, hence we employed a Kruskall-Wallis instead of an ANOVA). We found a significant difference between the networks with respect to degree ($\chi^2 = 19,690$ df = 2, $p = 0.000$) and closeness centrality ($\chi^2 = 44,338$ df = 2, $p = 0.000$), but not for betweenness centrality ($\chi^2 = 0,603$ df = 2, $p = 0.740$). This tells us that the degree and closeness centrality scores are not evenly distributed among the networks, but the distribution of betweenness scores appears to be similar. We then conducted a pair-wise Games-Howell post-hoc test and found that network 1 was significantly different from network 2 and 3. We found no significant differences between network 2 and 3 (see Table 2). This implies that the division of roles, as described in other studies, is significantly different in network 1 compared to the other two networks, which may also imply a development over time.

These centrality metrics provide us an understanding of the structures and division of roles in the three studied networks. However, the numbers only give limited insights into these networks, because it does not tell us much about *how* network 1 actually differs from the other networks and *how* the individuals perform their alleged role. To deepen and contextualize our findings and detect subtler differences in the network structures and performed roles, and obtain a more thorough understanding of how the analyzed networks differed over time, we combined our quantitative

[42] See also de Bie and de Poot, "Studying police files".

[43] Stephen P. Borgatti, "Identifying sets of key players in a social network," Computational & Mathematical Organization Theory 12, no.1 (2006), pp. 21–34.

[44] Sparrow, "The application of network analysis".

[45] Krebs, "Mapping networks," Stollenwerk e.a., "Taking a New Perspective," Belli e.a., "Exploring the Crime-Terror Nexus."

[46] McGloin, "Policy and intervention considerations," Carlo Morselli, Inside criminal networks (New York: Springer, 2009).

Table 2
post-hoc test for comparison of actor level degree and closeness centrality means.

			Mean Difference	Std. Error	Significance
Degree	Network 1	Network 2	−0,1796794[a]	0,0435568	**0,001**
		Network 3	−0,1830074[a]	0,0439018	**0,001**
	Network 2	Network 3	−0,0033280	0,0557479	0,998
Closeness	Network 1	Network 2	−0,1568148[a]	0,0238577	**0,000**
		Network 3	−0,1716588[a]	0,0225228	**0,000**
	Network 2	Network 3	−0,0148440	0.0276138	0,853

[a] The mean difference is significant at the 0.01 level.

network analysis with a qualitative network analysis in the next section.

In the next paragraphs, we discuss each network separately and illuminate the network's *organizational structure* and *subjects' roles*. Network structures will be visualized in so called sociograms: the connections or ties between studied subjects are shown by the edges between nodes, while the edge thickness indicates the strength of their relation. Also, the nodes will be clustered in different communities, based on a modularity measure, which is demonstrated by the colors in the sociograms; nodes belonging to the same cluster have the same color. We will describe, interpret, and contextualize the quantitative clusters with qualitative analyses. Additionally, we will describe which subjects played a prominent role within the network. We therefore divided the subjects in two categories: *core members* and *supporters*. Core members are the precursors in the networks, who incite others to embrace the ideology and to conduct particular activities. Sometimes they are the "leaders", but foremost they form the backbone of the network. It is questionable whether these networks would survive without these core members. Supporters, however, are subjects who follow the core members and facilitate the network in different ways. They play a less dominant role, but form the majority of the network. We will mainly focus on the core members and illuminate only a minority of subjects in the next paragraphs.

4. Combining quantitative and qualitative results

4.1. Network 1

4.1.1. Network structure

The first network prepared several foreign fighting attempts to primarily Afghanistan and Pakistan and recruited numerous new members between 2001 and 2002. It has a strong international foundation, which resulted from the connections with the GSPC in Algeria, and the fact that several members came to the Netherlands after they fought jihad in other countries to expand the jihadist movement. The qualitative analysis shows that network 1 was a relatively well-structured and organized network. It seemed compartmentalized into several sections for operational reasons, which partly explains the lower density score and longer path length. The visualization of this structure is captured in Fig. 1. The network was centralized around four core members, who are indicated with diamonds in the sociogram (subjects 2, 14, 16, and 19). The core members were each in charge of a separate compartment or cell of recruits, with whom they had a hierarchical relation. The core members and their cells seem to operate autonomously, although the core members communicated with each other on a regular basis. The other nodes in the sociogram are the *supporters*, illustrated with a circle, which are mainly recruits, followers, or operational facilitators.

To validate the compartmentalization, we applied a modularity measure and found that the communities resemble the compartments or cells to a certain extent. The blue community

(density = 1)[47] is formed around core member 14 and three followers with whom he regularly participates in sporting classes, allegedly for terrorist training purposes. The yellow cluster (density = 1) is formed around core member 19 and two supporters. The red community (density = 0.54) forms the ideological core of the network, encapsulating two core members (2 and 16) and many other key facilitators. The inclusion of two core members in one compartment seems odd, and is probably a direct effect of excluding many recruits from the dataset due to a lack of information.[48] The network is in reality much larger than the 34 nodes, which explains why the modularity measure does not fully correspond to the qualitatively identified compartmentalization. Besides the clustering around the core members, this network also contains a subgroup of subjects who merely conducted criminal activities, commissioned by core member 2, such as large scale passport forgery, shoplifting, burglaries, and drug transportations. These criminal conducts were helpful to logistically or financially support the journeys to conflict areas.[49] This additional network partitioning is illustrated by the modularity measure, which clustered several subjects into one community (green community, density = 0.47) who were mainly undocumented. Many of them form the periphery of the network with weak connections throughout the network, although those subjects who conducted many criminal activities were strongly connected to each other and only weakly connected to the ideological communities. Most subjects in the green community were less ideologically devoted to the jihadi-salafist doctrine or the goals of the core members, and the pragmatic value of the network seems to be the most appealing factor to them.[50]

Due to the network's compartmentalization, subjects were able to conduct large scale crimes on a structural basis by one compartment or cell, while other compartments successfully focused on the recruitment, training and ideological education of new members. As a result of this seemingly strict division of labor and connections the overall density was decreased, which lowered chances of exposure. At the same time this increased the density within the separate compartments which increased the efficiency of communication.

4.1.2. Roles

Taking a closer look at the individual subjects, we observe that the core members do not have an entirely equal relation. Subject 2 seems to be the *primus inter pares*. He is a charismatic ideologue who acquired a high social status due to his religious knowledge and numerous international contacts (in 119 countries according to his phone records). He is known by fellow subjects as the president of the "Room of Safety and Stability" where he ideologically

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[47] Density is not weighted, just based on plain number of contacts.
[48] This means that the centrality scores are heavily affected by this omission and qualitative data is therefore necessary to illuminate a more realistic picture.
[49] See also Jasper L. de Bie, Christianne, J. de Poot, and Joanne P. van der Leun, "Jihadi networks and the involvement of vulnerable immigrants: reconsidering the ideologial and pragmatic value," Global Crime 15, no.3–4 (2014), pp. 275–298.
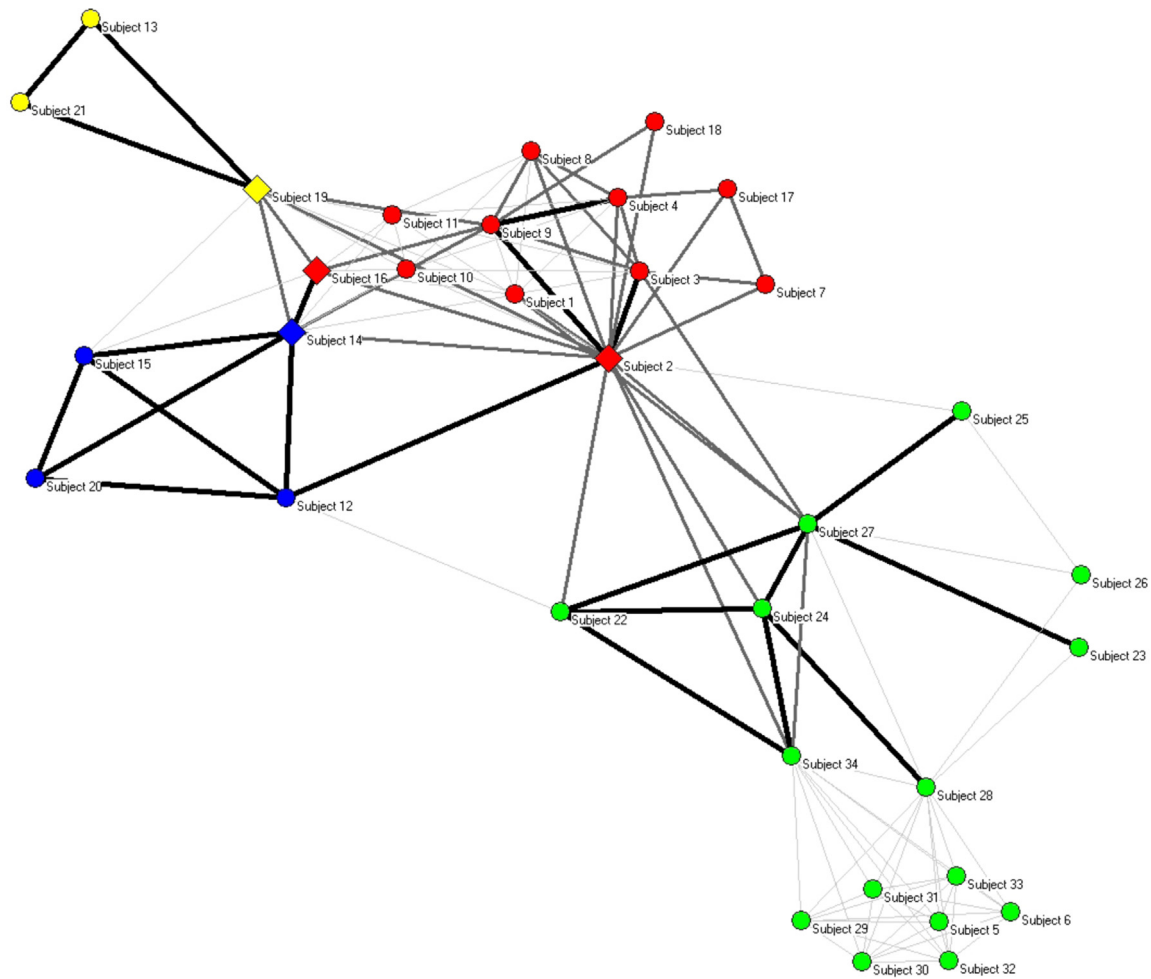[50] Ibid.

Fig. 1. Sociogram network 1.

educates other subjects. The police for instance found a so-called "jihadi-library" in his home with thousands of radical tapes and documents. Besides being an ideological and operational leader, he is also a broker between the core group and the green cluster. He communicates primarily with the main criminal facilitators, subjects 22, 24, 27, and 34, who predominantly communicate with subject 2. This narrowed communication flow explains the high network level betweenness and closeness scores. The central and broker positions of subject 2 are also illustrated by the centrality scores in Table 3, where he ranks first for all centrality scores with quite a lead towards the rest. However, the centrality scores in Table 3 only partly correspond to the qualitative categorization of the other core members (highlighted cells), because they are not structurally ranked as the most centralized subjects. We notice for instance that subject 16, who is a jihad veteran with extensive ideological knowledge, has a very low rank on all centrality scores, despite his status as a popular and admired theologian who builds close relationships with new recruits. On the one hand, this is caused by the aforementioned exclusion of many recruits. On the other hand, the demotion of core members from the top centrality ranks results from the unexpected centralized position of the criminal facilitators, such as subject 27, 34 and 28 in particular. Subject 27 is probably the most important criminal facilitator due to his strong relationship with subject 2, who commissions him to forge passports. During house searches, the police found many false passports and professional equipment that enabled him to forge the passports. In addition, subject 27 is also accused of help-

ing subject 2 to escape from prison in collaboration with subject 22, 24, and 34. Because subjects 28 and 34 have the most direct contacts with many relatively "isolated" undocumented immigrants in the network's periphery (with whom they allegedly commit criminal activities), they score relatively high on betweenness centrality. This is an interesting finding, because the centrality scores thus directed us to the most important criminal facilitators of the network, but not to all core suspected terrorists. Hence, the qualitative analysis provides context that is necessary to interpret and validate key subjects identified by the SNA, based on their centrality scores.

4.2. Network 2

4.2.1. Structure

Network 2 is a home-grown network that operated in 2005–2006. The network prepared two foreign fighting attempts, although for the most time it aimed to disseminate a radical doctrine. The underlying structure of network 2 was very different from the structure of network 1. Instead of a clear hierarchical cell structure with leading core members, subordinate recruits, and strong international connections, network 2 is a horizontal network with a weak leadership, and no international foundation. This network consists mainly of so called *homegrown jihadists* who grew up in the Netherlands. The homegrown jihadists are a mix of young foreign fighting potentials and jihadist sympathizers of whom many got involved with the jihadist movement through self-radicalization. Despite self-radicalization, the subjects looked for guidance and

Table 3
actor level centrality scores for network 1.

Network 1						
CD(ni)		Weighted CD(ni)		Rank	CB(ni)	CC(ni)
0.5758	Subject 2	0.3455	Subject 2	1.	0.4897 Subject 2	0.7021 Subject 2
0.3636	Subject 28	0.2061	Subject 27	2.	0.2856 Subject 34	0.5690 Subject 34
0.3636	Subject 34	0.1939	Subject 14	3.	0.1305 Subject 19	0.5500 Subject 27
0.3030	Subject 14	0.1758	Subject 9	4.	0.1264 Subject 27	0.5238 Subject 22
0.3030	Subject 27	0.1576	Subject 19	5.	0.0602 Subject 28	0.5156 Subject 1
0.3030	Subject 19	0.1455	Subject 34	6.	0.0498 Subject 14	0.5077 Subject 24
0.2727	Subject 3	0.1394	Subject 3	7.	0.0368 Subject 12	0.5000 Subject 14
0.2727	Subject 1	0.1394	Subject 24	8.	0.0327 Subject 1	0.5000 Subject 19
0.2727	Subject 9	0.1273	Subject 12	9.	0.0239 Subject 22	0.4925 Subject 9
0.2424	Subject 31	0.1212	Subject 4	10.	0.0218 Subject 3	0.4853 Subject 3
0.2424	Subject 30	0.1152	Subject 22	11.	0.0177 Subject 9	0.4853 Subject 11
0.2424	Subject 29	0.1091	Subject 16	12.	0.0131 Subject 16	0.4853 Subject 10
0.2424	Subject 32	0.1030	Subject 15	13.	0.0112 Subject 25	0.4853 Subject 16
0.2424	Subject 11	0.0970	Subject 28	14.	0.0092 Subject 24	0.4583 Subject 4
0.2424	Subject 10	0.0910	Subject 20	15.	0.0077 Subject 11	0.4521 Subject 12
0.2424	Subject 33	0.0910	Subject 8	16.	0.0077 Subject 10	0.4521 Subject 8
0.2424	Subject 4	0.0788	Subject 1	17.	0.0064 Subject 4	0.4459 Subject 28
0.2424	Subject 16	0.0606	Subject 13	18.	0.0063 Subject 15	0.4459 Subject 25
0.2121	Subject 6	0.0606	Subject 21	19.	0.0043 Subject 26	0.4286 Subject 7
0.2121	Subject 5	0.0545	Subject 17	20.	0.0011 Subject 8	0.4286 Subject 17
0.2121	Subject 8	0.0545	Subject 7	21.	0.0006 Subject 7	0.4231 Subject 18
0.1515	Subject 24	0.0485	Subject 32	22.	0.0006 Subject 17	0.4074 Subject 31
0.1515	Subject 12	0.0485	Subject 29	23.	0.0003 Subject 31	0.4074 Subject 29
0.1515	Subject 22	0.0485	Subject 11	24.	0.0003 Subject 30	0.4074 Subject 30
0.1515	Subject 15	0.0485	Subject 33	25.	0.0003 Subject 32	0.4074 Subject 32
0.0909	Subject 25	0.0485	Subject 10	26.	0.0003 Subject 29	0.4074 Subject 33
0.0909	Subject 26	0.0485	Subject 31	27.	0.0003 Subject 33	0.4024 Subject 6
0.0909	Subject 17	0.0485	Subject 30	28.	0.0000 Subject 20	0.4024 Subject 5
0.0909	Subject 20	0.0424	Subject 6	29.	0.0000 Subject 6	0.3976 Subject 26
0.0909	Subject 7	0.0424	Subject 5	30.	0.0000 Subject 23	0.3929 Subject 23
0.0606	Subject 13	0.0424	Subject 25	31.	0.0000 Subject 21	0.3626 Subject 15
0.0606	Subject 23	0.0364	Subject 18	32.	0.0000 Subject 5	0.3474 Subject 20
0.0606	Subject 21	0.0364	Subject 23	33.	0.0000 Subject 18	0.3402 Subject 13
0.0606	Subject 18	0.0182	Subject 26	34.	0.0000 Subject 13	0.3402 Subject 21

support from other jihadists. Several subjects in network 2 were able to provide this support, which demonstrates a form of demand and supply between subjects.

Due to the flat and decentralized structure of the network, the (potential) foreign fighters could not rely on large scale criminal activities that would logistically or financially support their journeys. Instead, they had minimal financial capital which they acquired from low paying jobs, and they were forced to make use of low profile training opportunities.[51] We observed that, like network 1, network 2 compartmentalized in a certain way to expedite these actions and to become operational. More precisely, several potential foreign fighters gathered in small groups or cliques and relied on the expertise of a single senior jihadist (subject 21, see *Roles* for more details). Two cliques were found; one aiming for Chechnya (subject 64, 65, and 68), another for Iraq/Afghanistan (subject 37, 59, 60, and 66). The latter clique explicitly requested the assistance of subject 21 because of his international contacts and ability to collect money. This senior jihadist was open to this request and eagerly tried to facilitate the logistical and financial side and guided them through the mental and physical preparations of the journey. Although the compartmentalization of two foreign fighting cliques was not as efficient due to double preparations, it did enhance security. Once the first clique got arrested in Azerbeidzjan, this did not lead to the immediate exposure of the second clique.

However, the compartmentalization is not absolute, but rather variable and depends upon the type of activity the members are conducting. For example, regarding the other core activity of disseminating and consolidating the Jihadi-Salafist doctrine, we found that the subjects did not cling to the foregoing delineated cliques. The reason for this is that unlike network 1 this activity was not guided by senior ideologues, but several young jihadists stepped up as missionaries of the Jihadi-Salafist doctrine and aimed to educate others through a horizontal rather than hierarchical form of communication. As a result, the subjects frequently interacted during (secret) ideological gatherings, where they would exchange and discuss ideological material.[52] The gatherings occurred in different settings that constantly altered in formation of attendees, leading to many different people meeting each other. Whereas the network's density and average connection increased due to this interactive nature, the average path length and the network level betweenness and closeness scores decreased in comparison to network 1, as shown in Table 1 and Fig. 2. Moreover, it also intensified relational strength in comparison to network 1, as illustrated by the edges in Fig. 2 and the relatively higher weighted degree centrality scores in Table 4. This increased social interaction was very efficient for the dissemination and consolidation of the ideology, although it did increase the risk of exposure as well.

The modularity measure captures both core activities in a meaningful and interesting network compartmentalization. The red community (density = 0.80) contains the first clique of foreign fighters (subject 64, 65, and 68) – which is scarcely connected to the other two communities – and the operational guide (subject 21) of both foreign fighter cliques (see *Roles* for more details on this

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[51] Ibid.

[52] See also Jasper L. de Bie, "Involvement mechanism of jihadist networks," Perspectives on Terrorism 10, no.5 (2016), pp. 1–20.
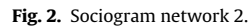
Fig. 2. Sociogram network 2.

Table 4
actor level centrality scores for network 2.

Network 2							
CD(ni)		Weighted CD(ni)		Rank	CB(ni)		CC(ni)	
0.7917	Subject 21	0.5750	Subject 21	1.	0.2079	Subject 21	0.8276	Subject 21
0.7083	Subject 60	0.4750	Subject 60	2.	0.1232	Subject 61	0.7742	Subject 60
0.6667	Subject 61	0.4667	Subject 61	3.	0.0860	Subject 63	0.7500	Subject 61
0.6250	Subject 63	0.4333	Subject 59	4.	0.0823	Subject 66	0.7273	Subject 63
0.6250	Subject 66	0.4250	Subject 66	5.	0.0693	Subject 19	0.7273	Subject 66
0.5833	Subject 59	0.3917	Subject 63	6.	0.0660	Subject 60	0.7059	Subject 59
0.5000	Subject 19	0.3000	Subject 70	7.	0.0261	Subject 59	0.6667	Subject 19
0.4167	Subject 70	0.3000	Subject 40	8.	0.0236	Subject 58	0.6316	Subject 70
0.4167	Subject 40	0.2833	Subject 19	9.	0.0177	Subject 71	0.6316	Subject 40
0.4167	Subject 37	0.2833	Subject 37	10.	0.0149	Subject 70	0.6316	Subject 71
0.4167	Subject 71	0.2833	Subject 71	11.	0.0128	Subject 76	0.6154	Subject 69
0.3750	Subject 69	0.2583	Subject 58	12.	0.0057	Subject 40	0.6154	Subject 67
0.3750	Subject 67	0.2417	Subject 67	13.	0.0047	Subject 37	0.6154	Subject 76
0.3750	Subject 76	0.1917	Subject 69	14.	0.0027	Subject 69	0.6154	Subject 37
0.3750	Subject 58	0.1917	Subject 76	15.	0.0015	Subject 67	0.5854	Subject 62
0.2917	Subject 62	0.1917	Subject 72	16.	0.0007	Subject 72	0.5714	Subject 58
0.2917	Subject 72	0.1750	Subject 62	17.	0.0007	Subject 62	0.5455	Subject 72
0.2500	Subject 54	0.1750	Subject 74	18.	0.0005	Subject 75	0.5333	Subject 74
0.2083	Subject 74	0.1667	Subject 68	19.	0.0000	Subject 74	0.5217	Subject 54
0.1667	Subject 65	0.1667	Subject 65	20.	0.0000	Subject 77	0.5106	Subject 75
0.1667	Subject 68	0.1667	Subject 64	21.	0.0000	Subject 64	0.4898	Subject 64
0.1667	Subject 64	0.1667	Subject 54	22.	0.0000	Subject 68	0.4898	Subject 65
0.1250	Subject 75	0.1083	Subject 75	23.	0.0000	Subject 73	0.4898	Subject 68
0.0833	Subject 73	0.0667	Subject 77	24.	0.0000	Subject 54	0.4706	Subject 73
0.0833	Subject 77	0.0500	Subject 73	25.	0.0000	Subject 65	0.4706	Subject 77

community).[53] Additionally, the green community (density = 0.81) is the core of the network in which most male jihadist sympathizers are located. This community is the most active in the network and several subjects are indicated as core members in Fig. 2 (diamond nodes), because they are the forerunners on different levels. It contains the other clique of foreign fighters (subject 37, 59 and 60), complemented with subjects that are primarily active with educating the Jihadi-Salafist ideology to random *supporters* (circle nodes). This green community is highly connected to the blue community, but can be distinguished based on gender. The blue community (density = 0.53) merely contains female subjects (with the exception of peripheral subject 73), who communicated on a regular basis and who often gathered separately from the men. Again, this compartmentalization is not absolute, because several female subjects are married to subjects from the green community and thus interact frequently as Fig. 2 illustrates. Also, several female subjects (like subject 63, 66, and 70) are sometimes present during male meetings, although they are seated in separate rooms or are separated by curtains. This indicates that the community boundaries are somewhat fuzzy, and the strictly delineated cliques only emerge for preparing the foreign fighting attempts. In comparison to network 1, the compartmentalization of network 2 therefore has a different nature.

4.2.2. Roles

When we focus on the individual subjects, we find that the quantitative analysis corresponds to our qualitative categorization of several *core members* (21, 59, 60, 61, 63, and 66; diamonds in Fig. 2). These subjects indeed have the highest scores on the centrality metrics in Table 4 (highlighted cells). In comparison to network 1, however, we found that the core members are different in nature. The qualitative analysis demonstrates that instead of being an operational leader, they rather appear to be forerunners in the network. Instead of being an explicit jihad recruiter, they prefer to go on jihad themselves. They have a guiding instead of a leading role, and they motivate instead of recruit others to internalize the ideology and become a valuable asset to the jihadist movement. They portray this role mainly during the many ideological gatherings that they attend and often organize, which enabled them to frequently meet and communicate with most *supporters*.

The position of subject 21 is an interesting example in that respect. As mentioned, he is an operational guide who facilitates the foreign fighting journey to Chechnya (subject 64, 65, 68) and Iraq/Afghanistan (subject 37, 59, 60, 66). He acquired his aforementioned status through his work as a financial facilitator in network 1, for which he travelled the world. At that time, he closely collaborated with subject 19, who he considers his ideological mentor. Subject 19 was one of the core members in network 1, but only plays a marginal role in network 2. The fact that subject 21 and 19 live together explains the number of contacts subject 19 still has in network 2, resulting in relatively high centrality scores. They are both grouped in the red community together with a clique of foreign fighters (subject 64, 65, 68) who mainly prepared their journey from the house of subject 21 and 19. Because these foreign fighters have no contact with other subjects in the network, subject 21's betweenness score increased. According to the qualitative analysis, subject 21's role in the green community is just as important, which makes his community position complex. For example, he assists the foreign fighters from the green community with the collection of money and he brings them in contact with a passport facilitator, subject 62 (red community). To meet subject 62, the

telephone communication runs solely through subject 21, making him indispensable. Interestingly, while he operated with minimal influence in network 1, he became the most centralized subject in network 2. Although he ranks first on all centrality metrics, his guiding position is not unimpeachable. For instance, subject 21 fails to materialize the planned preparation and consequently the potential foreign fighters never depart. His status eventually deteriorates once the other subjects ideologically outgrow him and because he beats his newlywed wife, subject 66, which is core member 59's sister.

Whereas subject 21's position as a core member eroded, the positions of several other members developed. Core member 61 for instance acquired high social status due to extensive ideological knowledge and being a respected ideologue in the green community. He is much younger than the ideologues in network 1, but people look up to him regardless. The fact that he speaks Arabic, unlike other home grown jihadists, contributes to this. It grants him authority and access to many ideological sources. He spreads his knowledge via the ideological gatherings, which he organizes in collaboration with his wife, subject 63. They meet many other (potential) jihadists this way, which explains their high centrality scores. At the same time, subject 63 has a strong ideological position of her own. She is an ideological forerunner in the blue female community and teaches other woman how to behave.[54] Subject 63 also introduces several women to the male subjects in the green community. You could say that she connects the clusters and that subject 61 partly thanks his increased centrality scores to her. This broker-like position is further underlined due to her active distribution of ideological material through chat boxes and websites to external sympathizers. This is how she lures subject 73 into the movement for example. Because we cannot include all her external contacts in the dataset, her broker position is not reflected as strongly in the associated betweenness score as it could have been. Regardless, when it comes to consolidating and spreading the extremist Jihadi-Salafist doctrine, subject 61 and 63 form a much bigger threat than subject 21, despite their lower centrality ranks.

4.3. Network 3

4.3.1. Structure

Network 3 operated between 2008 and 2013 and has a comparable network structure as network 2. It is a horizontal and fluid network without a formal centralized leadership. It mainly consists of homegrown jihadists of whom several were also present in network 1 and 2 (subject 19, 21, 64, 65). Despite its resemblance, we also found that the social interaction within network 3 was more diffuse and dynamic than before. The extended time-frame of network 3 illustrates this dynamic nature. We found that over the years, the jihadist movement became one large pool of jihadist sympathizers who gathered in different formations at different locations to exchange ideological information and to consider the possibility of violent measures.

This pool of jihadists had an open character, meaning that the network boundaries are fuzzy, leading to high social mobility between network members as well as with external people. This manifested as follows. Within this large pool of jihadist sympathizers, we found that subjects adopted a more outward focus to exchange ideological information. Besides the traditional private lectures and gatherings, we noticed for instance that online communication became one of the most important means of mass communication to openly expose and spread the ideology. We also observed that so called *street preachers* (subject 21, 84, 85, 86)

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[53] Modularity does not indicate overlap of clusters. A subject is therefore only part of one community, whereas in reality he might be part of more than one community (as is the case with subject 21).

[54] Female core member 66 functions in a similar way, but to a lesser extent.
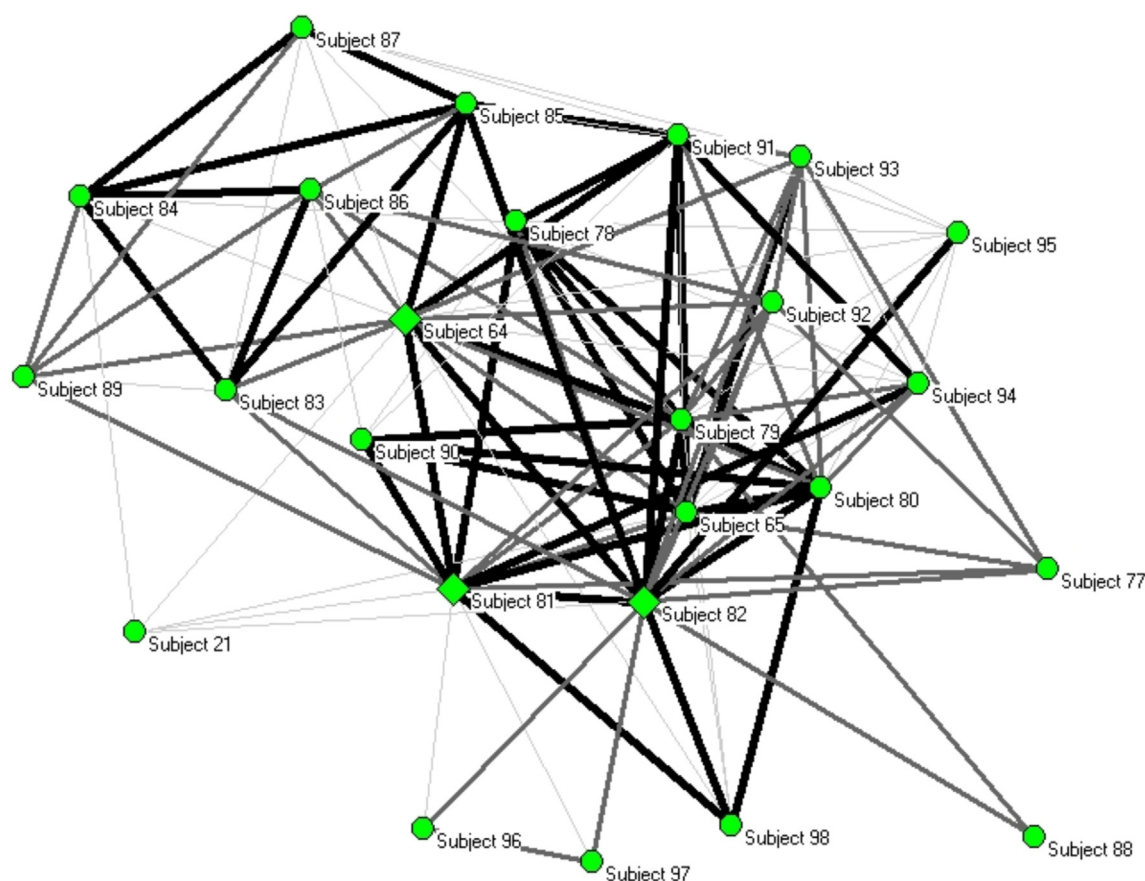
Fig. 3. Sociogram network 3.

randomly and openly addressed strangers to inform them about the ideology. Likewise, they distributed flyers in the surroundings of Mosques and in public areas to promote upcoming ideological events. Such events were for instance ideological demonstrations, where a variety of likeminded people publically shared their (radical and provocative) thoughts and ideas. Hence, distribution of the ideology became more public and had an exterior character, thus eroding the traditional secretive nature. This may have been caused by the political and judicial climate. Whereas the government explicitly targeted people who seemed to spread extremist narratives in the era of network 1 and 2–forcing these subject to be secretive – the subjects in network 3 seemed to have learned from the fact that hardly anyone was convicted for merely doing so, allowing space for public representation. This increased the social mobility of subjects, as said, and intensified relations as the edges in Fig. 3 show. Moreover, this resulted in a slight increase in network density and average node contact, and a slight decrease in the average path length and the network level centrality scores as portrayed in Table 1. This means that network 3 became slightly denser than network 2. Although these quantitative differences are minimal and not necessarily significant, the qualitative analyses clearly show that due to the dynamic social interaction, network 3 resembled a fluid protest movement, rather than a static group. The outermost boundary of network 3 as well as the inner contours of the network structure is therefore less perceptible in comparison to network 1 and 2. Due to the unclear outermost boundary, network 3 was probably much larger than the 25 nodes we studied; according to the criminal investigator the network counts 50 people in total, including less significant sympathizers in the network's periphery. Unfortunately, we were unable to identify all related subjects. In addition, due to the unclear contours, clusters within

the network are difficult to identify. The modularity score of network 3 was below 0.3 (see Table 2), which means the threshold for meaningful clusters is not reached. Furthermore, we were unable to meaningfully elaborate clusters from the modularity measure with qualitative analyses, which confirms the fluid nature of the network. Modularity communities are therefore left out Fig. 3.

Notwithstanding the fluid nature of the network, we did identify a form of network compartmentalization. Like network 2, subjects assembled in cliques of four people to go on jihad. For example, subject 64 and 65, who already belonged to a foreign fighting clique in network 2, were separately identified as part of a clique that headed for Somalia (subjects 78, 79, 65, 80) and Turkey (64, 82, 85, 91) in 2009. Another clique aimed for Pakistan (78, 81, 94 and 85) in 2011, although only subject 78 reaches the final destination. In addition, several foreign fighting attempts were made to Syria in 2012 and 2013, but the data are less clear about any clique forming. Unlike the distinct compartmentalization in network 1 and the clearly separated cliques in network 2, the formation of cliques is highly variable in network 3, as several subjects belong to more than one clique. This illustrates, more than in network 2, that subjects in the fluid network only collaborate in small and distinguishable groups when they become operational for the Jihad. Unlike network 1, they seem to operate autonomously and cannot rely on the benefits of organized crime for financial and logistical support in that regard.[55]

Having said that, we do notice some parallels with network 1 as network 3 became slightly more organized and international over the years. Several core members took the lead in that respect, when

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[55] See also de Bie e.a., "Shifting modus operandi of jihadist foreign fighters".

Table 5
actor level centrality scores for network 3.

Network 3									
CD(ni)		Weighted CD(ni)		Rank	CB(ni)		CC(ni)		
0.7917	Subject 82	0.5917	Subject 82	1.	0.1797	Subject 82	0.8276	Subject 82
0.7917	Subject 64	0.4667	Subject 81	2.	0.1203	Subject 81	0.8276	Subject 64
0.6667	Subject 79	0.4462	Subject 64	3.	0.1098	Subject 64	0.7500	Subject 79
0.6667	Subject 81	0.4333	Subject 79	4.	0.0748	Subject 79	0.7500	Subject 81
0.6250	Subject 65	0.4083	Subject 65	5.	0.0369	Subject 65	0.7273	Subject 65
0.5000	Subject 80	0.4000	Subject 80	6.	0.0257	Subject 93	0.6667	Subject 80
0.5000	Subject 93	0.3333	Subject 91	7.	0.0185	Subject 86	0.6667	Subject 93
0.5000	Subject 91	0.2833	Subject 85	8.	0.0184	Subject 91	0.6667	Subject 91
0.4583	Subject 78	0.2750	Subject 78	9.	0.0180	Subject 78	0.6486	Subject 78
0.4167	Subject 94	0.2500	Subject 93	10.	0.0138	Subject 84	0.6316	Subject 94
0.3750	Subject 95	0.2167	Subject 86	11.	0.0136	Subject 83	0.6154	Subject 95
0.3333	Subject 87	0.2167	Subject 84	12.	0.0125	Subject 87	0.6000	Subject 83
0.3333	Subject 83	0.2167	Subject 83	13.	0.0113	Subject 85	0.6000	Subject 85
0.3333	Subject 86	0.2000	Subject 92	14.	0.0104	Subject 92	0.6000	Subject 92
0.3333	Subject 85	0.2000	Subject 94	15.	0.0095	Subject 80	0.5854	Subject 90
0.3333	Subject 84	0.1917	Subject 90	16.	0.0056	Subject 90	0.5714	Subject 87
0.3333	Subject 92	0.1500	Subject 98	17.	0.0051	Subject 89	0.5714	Subject 98
0.2917	Subject 90	0.1500	Subject 87	18.	0.0051	Subject 21	0.5714	Subject 86
0.2500	Subject 89	0.1333	Subject 89	19.	0.0019	Subject 94	0.5581	Subject 89
0.2500	Subject 98	0.1250	Subject 77	20.	0.0005	Subject 77	0.5581	Subject 21
0.2083	Subject 21	0.1083	Subject 95	21.	0.0005	Subject 95	0.5455	Subject 77
0.2083	Subject 77	0.0583	Subject 97	22.	0.0000	Subject 88	0.5455	Subject 84
0.1250	Subject 97	0.0583	Subject 96	23.	0.0000	Subject 97	0.5000	Subject 96
0.1250	Subject 96	0.0500	Subject 88	24.	0.0000	Subject 98	0.5000	Subject 97
0.0833	Subject 88	0.0417	Subject 21	25.	0.0000	Subject 96	0.5000	Subject 88

they galvanized others to become more proactive in the jihadist movement. They did so in a more planned manner when compared with network 2. The subjects in network 3 tried to give the foregoing protests and demonstrations a formal nature by branding it. Particular symbols or trademarks were used to announce upcoming events, draw additional support, and legitimize their actions in response to the criminalization by the government. As a result, they expressed themselves as a protest movement, rather than a terrorist organization. In addition, the foreign fighting attempts became better organized as well, which is illustrated under *Roles*. The intensification of contacts abroad lay at the basis of this. Whereas the international fundament of network 1 was the result of incoming international jihadists who brought the jihadist movement to the Netherlands, homegrown jihadists from network 3 spread their wings, gained international experience through foreign fighting and then returned to share their experience. Unlike network 2, they successfully created an international basis for themselves after multiple foreign fighting attempts.

4.3.2. Roles

Building on the organizational development and internationalization of the network, we take a closer look at several individual subjects who were responsible for this. Due to the extended timeframe, the division of roles changed over time, which was especially notable with the core members. When this network initially drew the police's attention, they primarily focused on subject 64. He was a foreign fighter in network 2 and although he never actually fought, he enjoyed the status of a jihad veteran in network 3. Accompanied by several others, he preached radical statements in a local mosque, leading to his expulsion. Henceforth, he started collecting jihad money and became a forerunner of the Jihadi-Salafist doctrine outside the mosque, which increased his direct contacts and high degree centrality score. As part of a clique he travelled to Turkey in 2009, where he is allegedly dropped off to become the broker between the Netherlands and Pakistan. Whether he became a successful broker is difficult to validate, because we have no evidence of foreign fighting attempts coordinated by him. If he indeed was able to coordinate foreign fighting attempts from his base in

Turkey, his betweenness score could have been much higher, if we had included external contacts. This would further validate his broker position. Nonetheless, he was arrested in Turkey for his alleged connections with Al Qaida, which meant other people had to fill his position. Subject 81 and 82 seemed to fill this gap and became the primary core members in network 3 (highlighted cells in Table 5). They are known throughout the network, which explains their high centrality scores. Moreover, according to an investigator, all subjects from network 3 are in contact with them. However, because we based the connections in our SNA on evidence from the police files, their centrality scores may be underrated which would be in line with the investigator's statement. Together they become the network's forerunners who ideologically motivated the supporters and prepared the jihad journeys, although there seems to be a distinct division of labor between them. For example, like subject 64, subject 81 is considered a jihad veteran due to his part in the 2011 clique that travelled to Pakistan. He was arrested and detained for months at the Iranian-Pakistani border, which brought him a significant social status upon return. The police consider him to be the operational coordinator who arranges all foreign fighting attempts to Syria in 2013. Since he is able to directly communicate with fixers on the Turkish-Syrian border, he facilitates the logistics for the foreign fighters. Due to his external contacts overseas, he is regarded by the police as the prime broker and his position is allegedly of crucial importance to successfully coordinate other subjects' foreign fighting attempts. However, he does not have the highest betweenness score, which is probably the result of not including external contacts. Whereas subject 81 has the external focus and arranges the practical side of foreign fighting attempts, subject 82 has the internal focus and communicates with many jihadist sympathizers and other followers who may want to become a foreign fighter. He is being monitored by the police for years and has extensive ideological expertise. He provides lectures in different mosques or in informal house settings. He also is one of the initiators to brand the movement. Under these brands he organizes several protests and demonstrations through which he incites others to internalize the doctrine. He expresses himself as a leader during these events, via

which he builds many direct contacts. This explains his top ranked position on all centrality metrics. He becomes well known in the Netherlands and does not appear to be afraid of public attention. He seems to explicitly want to face the media and he does that on a regular basis; he publishes online and he is interviewed on national television. In sum, both quantitative and qualitative analyses seem to confirm that subject 81 and 82 successfully succeeded subject 64 as the primary core members in network 3, who tried to bring the operational foundation of the network to a new level.

If we look at Table 5, there are some other subjects that deserve attention. Subject 79 and 65 for instance have relatively high centrality ranks, but are not considered core members. They were part of the 2009 clique travelling to Somalia, where they were arrested and which led to the deportation of subject 79 to his native country Morocco. Allegedly he was re-arrested and tortured in a Moroccan prison, which only motivated him more to travel to Syria in 2013, where he eventually was killed in battle. In addition, subject 65 was already part of a foreign fighting clique in network 2, which shows his longitudinal presence in the jihad movement. However, he struggles with mental issues and consequently shows odd behavior. Although subjects tolerate his behavior, it seems to make him unsuitable for a key role. These backgrounds of both subjects illustrate their determination and may explain the high number of direct contacts they made during different foreign fighting attempts, gatherings, and events. This does however not indicate power, leadership, and a centralized position, despite their relatively high centrality scores, especially when you take into account the mental health of subject 65's. Because they have no significant operational or broker positions either, we categorized them as active supporters rather than core members.

5. Conclusion

By means of *social network analysis*, based on longitudinal data derived from police files, interviews, and field notes from court sessions, this paper analyzed the network differences of jihadist networks in the Netherlands between 2000 and 2013. This mixed method of qualitative and quantitative analyses enabled us to compare the *organizational structures* and *subjects' roles* of three different networks that were active during a particular episode, and facilitated us to see to what extent particular network features and assumptions applied to the Dutch case. We found that the jihadist movement changed from a hierarchically organized network with a distinct cell structure and a strong international foundation, to a fluid dynamic homegrown network without a clear leadership. The analyses and different sociograms show that over time the relationships between subjects intensified, and subjects appeared to be located closer to each other. Somewhat counter-intuitively, the networks became denser over time, in spite of their fluid nature. Yet, network 3 also demonstrated parallels with network 1, which suggests an ongoing development of network structures.

A more detailed depiction of this dynamic nature can best be illustrated with regard to the *efficiency-security trade-off.* We found that the studied network demonstrated a form of compartmentalization, which can effectuate a balance in the trade-off, as argued by several other scholars. The sociograms and the modularity scores quantitatively illustrated several dense communities in which the members are more strongly connected to each other than to subjects from other communities. However, the nature of compartmentalization can differ. Whereas network 1 demonstrated the often referred and preferred compartmentalization of a strictly distinguished and non-redundant cell structure, network 2 and 3 did not. This is not odd, considering the fact that the density of network 2 and 3 were a lot higher than network 1, suggesting a more coherent organizational structure with more redundant ties.

Nonetheless, based on qualitative analyses we found that network 2 and 3 did show a relative compartmentalization, in the sense that subjects formed cliques within their embedded and dense social environment. Somewhat counter-intuitively, it appears that compartmentalization can thus occur alongside a higher network density. An explanation for this is that network structures are flexible and may vary per activity. On the one hand, when subjects aim to conduct criminal activities or prepare foreign fighting attempts for example, they tend to cluster together in smaller and denser cliques or communities. In network 1 there was a clear division of labor in that respect, which was accompanied with separated communities. Foreign fighters in network 2 and 3 then were more socially embedded in the larger network, but they shielded their foreign fighting preparations from the rest of the network by working in smaller cliques. Hence, by keeping the communication purely functional, the efficiency in the cells and cliques increased but the rest of the network was protected from unwanted exposure. On the other hand, the core activity of disseminating the ideology required a different balance in which compartmentalization was less preferred. In network 2 and 3 for instance, the ideological dissemination had a broader reach due to the increased use of internet. This outward focus and altering settings increased higher network density, which facilitated the process of ideological dissemination even further. Instead of covertly compartmentalizing the network, this social mobility among jihadists intensified, leading to more and more network exposure. Although there was some form of compartmentalization, in the sense that gatherings were separated based on gender, this separation was grounded on religious rather than security considerations. Exposure and minimal covertness rather appear to be the purpose of disseminating the ideology, especially in network 3, which means that efficiency seemed to be favored over covertness. This indicates that secrecy is not always prioritized in the efficiency-security trade-off, as often implied by other scholars, but depends on the activity.

Within the foregoing network structures, different kinds of actors play an essential role to conduct the different activities. With both qualitative and quantitative analyses, we identified so called core members. They were ideologically or operationally more active than others and clearly motivated others to become more active and involved. What is most interesting in that regard is that several subjects were present in more than one network, some of them even in all three, and that their roles developed over time. Some start as supporters in a network's periphery but evolved into core members in later networks. An explanation for this development is that they learned and gained social status from previous experiences. However, we also found that core members were different in nature. For instance, the international jihadists in network 1 appear to be more leader-like core members who seem to be both ideologue, operational leader, and broker, whereas the mainly homegrown core members in network 2 seem to be forerunners who guide instead of direct or recruit other subjects. Core members in network 3 illustrate resemblance to those from network 2, but with seemingly more operational power and charisma. In other words, network 3's core members mix particular features from their predecessors.

5.1. Implications

The dynamic nature of both network structures and roles shows that certain assumptions and conclusions in the literature, as indicated in the introduction, cannot be instantly derived from the quantitative SNA findings. The current findings show that network features can be far more complex than these assumptions indicate. This has several implications for both the academic and the policy domain.

First, the identified changes and differences between networks show how transient or perishable certain findings may be when merely looking at a static picture. This does not mean that the current findings are more valid than other studies, but unlike a static network analysis it emphasizes that organizational features and roles are more dynamic than often expressed. Not only due to the passing of time, but also because subjects adopt a dynamic network positioning to conduct different types of activities.

Second, although SNA was a suitable analytic tool to identify the differences, it was necessary to complete the analysis with complementary qualitative assessments. Without these assessments, we find that the assumptions regarding the implications of quantitative findings were not undisputedly correct. First, as illustrated above, the efficiency-security trade-off is more complex than often assumed; compartmentalization does not always guarantee a strict balance. We must be aware though that the studied networks are essentially extremist networks, rather than terrorist organizations. The one-time action assumption regarding terrorist groups does therefore not fully apply, limiting its influence on structure type. In addition, there may be a selection effect caused by police priorities. They may have identified different kinds of network structures, but primarily focused on one sort. Second, centralized figures are not necessarily leaders, and brokers (especially those with an exterior focus) could not always be identified with betweenness scores. The qualities of these different types of core members (human capital) are not easily detected with quantitative analysis only; the centrality metrics merely indicate the most centralized subjects (social capital). This is partially caused by the boundary specification problem. Due to our inclusion criteria we have omitted certain subjects from the analysis, which certainly affected the centrality scores. Nonetheless, we also noticed that being a central figure does not necessarily qualify one as a leader or a broker, but could also refer to a very socially mobile facilitator without any leadership competence. Whereas some facilitators operate in a network's periphery, others are centralized figures who are indistinguishable from the network's high ranked leaders.

Third, building on these SNA remarks, we argue that the value of SNA for law enforcement and intelligence investigations is ambiguous. It is certainly capable to visualize a network and to illuminate the centrality differences between suspects in a quick and orderly fashion, but without additional qualitative assessments it is arguable whether SNA inspired disruptions strategies are successful. If qualitative information is obtained, the next hurdle is to identify the core activities of a network. Awareness of diverging agenda's and varying goals is essential if you want to destabilize a network, because it may alter the network's structure or its reliance on either efficiency or security. This awareness may determine the effectiveness of a particular disruption strategy. For instance, in a high density network that primarily aims to disseminate the ideology, the often cited kingpin method will not disrupt a network. In that case, removing alleged leaders will not interrupt the communication flow between densely connected nodes, although removing external minded brokers may prevent a network from growing. On the contrary, when a network is preparing violent measures, removing central figures may be effective. Because it is more likely that security is enhanced by some form of compartmentalization, as illustrated in network 1, removing the essential ties between these communities may disrupt the communication flow and the necessary proceedings. However, as shown in this paper, extremist networks are likely to be oriented on both activities, which may involve dynamic network structures. In such cases, keeping network density low, but preventing the network from compartmentalizing could be a useful starting point to disrupt both activities.

To conclude, despite inherent limitations, this paper demonstrates the dynamic nature of the jihadist movement in the Netherlands. A mix of quantitative and qualitative SNA illuminates how networks are structured and how certain features within the jihadist movement have evolved over time. Additional studies must nonetheless be conducted to validate the current findings, especially since the phenomenon is changing rapidly and becomes more pressing at the moment this paper is in press.